GREEN MINES GREEN ENERGY–
LAND RECLAMATION SUCCESSES IN NORTHERN ONTARIO

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Natural Resources Canada's Green Mines Green Energy (GMGE) initiative is advancing mine site reclamation through the beneficial use of organic residuals for the sustainable establishment of energy crops and other productive land uses (Tisch et al. 2008). The feasibility component of the GMGE project was initiated in 2007 with specific objectives of demonstrating that mining lands can become agriculturally productive lands through the use of organic residuals as thick covers on tailings and as growth medium for plants (Tisch et al. 2008). The GMGE strategy for mine land reclamation offers many additional benefits including prevention of wind and water erosion and limiting of suphide oxidation and acid mine drainage through restriction of oxygen infiltration to the tailings. Other anticipated benefits of the GMGE initiative are beneficial management and reuse of organic residuals from a range of resource industry and urban sources, potential production of cash crops on brownfields, and a contribution from the mining industry towards greenhouse gas reduction through sequestration of carbon in the growth medium.

Last year marked the end of the first phase of the technical feasibility component of the GMGE initiative. Overall the project was a success, demonstrating that cultivation of biofuel crops in organic materials applied to the tailings was feasible. The project was previously published in Canadian Reclamation (Issue 1 Spring/Summer 2010), highlighting above average yields of canola and corn at Vale in Sudbury and Goldcorp in Timmins, while crops at Xstrata Nickel in Onaping were stunted due to nutrient deficiencies and cover compaction. In 2010, the focus of research at the Vale and Goldcorp sites was the continued maintenance of perennials planted in 2009 and metal dynamics within the organic covers and crops. At Xstrata, fertility and ripping treatments were incorporated into the experimental design to alleviate nutrient deficiencies and compaction, respectively. It was found that tailings-bound metals were not migrating into the covers at any of the sites. Crop health improvement at Xstrata in 2010 was significant in all treatments. However, crops grown in the high fertility treatment areas were most successful, achieving higher yields compared to the other treatments, suggesting that the limiting factor in 2009 was cover fertility.

Further evaluation of the study results showed that the crops generally performed better on the organic covers at the mine sites than they did at a regional agricultural site. Canola produced yields greater than the Ontario average (OMAFRA 2010). In 2009, canola grown at the Vale site in Sudbury (Figure 1) achieved a seed yield of 3.3 t ha^{-1} while the Ontario agricultural average was 2.2 t ha^{-1} (OMAFRA 2010). At these yields, it is estimated that 3,600 L ha^{-1} of biofuel could be produced from the tailings areas through cultivation of canola, using the GMGE model of reclamation (Doyletech Corporation 2010).

The current direction of the GMGE project is primarily the cultivation of switchgrass and short rotation hybrid willow (perennials). Because of the high yields attained for canola crops, canola will remain in rotation; however, cultivation of annuals tends to carry higher fertilizer and maintenance needs and requires yearly harvest and cultivation, which perennials do not. Furthermore, yearly cultivation of the organic covers accelerates decomposition of the organic matter, reducing the thickness of the covers. Perennial agro-ecosystems also contribute to the carbon content of the site, augmenting the sequestration potential of the area and helping to mitigate greenhouse gas emissions while creating the prospect of trading credits in the carbon market. This year, nearly 10,000 native and non-native willows have been planted at the GMGE sites (Figure 2). The willows were planted in a replicated experimental design allowing for variety trials to be completed over the next 3 - 5 years. Carbon accumulation and sequestration potential of the agro-forestry system will also be assessed. The willows are expected to grow on the order of 5 – 6 metres over the next three years, and on an operational basis would be harvested on a three year cycle.

FIGURE 1. CANOLA CROP GROWN AT THE VALE GMGE SITE IN 2009.

FIGURE 2. A WILLOW TREE PLANTED AT THE VALE GMGE SITE IN 2011.

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